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AUTHOR	Noor Al-Deen, Hana S.
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ABSTRACT

The utilization of teleconferencing as part of the information highway, mainly among schools in North Carolina, is examined. The National Information Infrastructure, outlined by Vice President Gore in January 1994, is the official name of the information system. The U.S. Congress issued four pieces of legislation in support of high-tech development. A number of states have initiated their own branch of the information highway. Two of the most ambitious projects are underway in North Carolina and California. North Carolina has employed a "Push" strategy whereby it emphasizes the public sector; California uses a "Pull" strategy that emphasizes commercial interests. North Carolina has adopted a statewide fiber-optic network called the North Carolina Information Highway (NCIH) and in 1994 began construction on a $160 million statewide Asynchronous Transfer Mode (ATM) network that will link state agencies, schools and universities, courts, doctors and hospitals, local governments, and private companies. A partial list of the offerings of the NCIH in schools includes distance learning, video field trips, video teleconferences, collaborative projects, teacher training, online research, electronic mail, and home/school communication. While the cost curve of incorporating the technology in schools continues to decline, the expense of joining NCIH is still considerable. Advantages of using the information highway for education include reducing the constraints of time and place, the ability to playback lessons, distance learning for senior citizens, and outreach programs to the handicapped. Opposition to the technology focuses on issues of performance failure, inability to translate crucial empiricism in science classes or nonverbal elements of language classes, and expense. Teleconferencing, in the future, may decrease or replace the traditional classroom; it may achieve equilibrium in schools, or put poorer counties at a great disadvantage. (Contains 47 references.) (AEF)

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EDUCATION MOVES INTO HIGH GEAR ON THE INFORMATION HIGHWAY

Hana S. Noor Al-Deen
Associate Professor
UNC-Wilmington
Wilmington, NC 28403
Office (910) 395-3402
Home (910) 251-0058
E-mail: noor@vxc.ocis.uncwil.edu

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With the dawn of electronic signals a century and a half ago, telecommunication technology began. It was initiated with the telegraph on May 24, 1844 between Baltimore, Maryland and Washington, D.C.. Seventeen years later, telegraph service became available throughout the United States (DeSola Pool, 1982; Meyer, et al., 1980; Schroeder, 1983). By 1876, the first patent was issued for the telephone; and, on October 9th of the same year, the world's first two-way telephone call was made between Boston and Cambridge, Massachusetts (Meyer, et al., 1980; Schroeder, 1983). Since then, telecommunication technology has been in a state of rapid expansion and development.

The teleconferencing system was originated during the early half of the 20th century. On February 25, 1911, the first audio conference was held between two advertising clubs in Buffalo and Rochester, New York (De-Mystifying, 1984). By the 1930s, the concept of teleconferencing, as an economic way to conduct business meetings across different geographical locations, was developed and diffused (Svenning, et al., 1984). In the 1960s and 1970s, a teleconferencing system was tested (field experiments) and/or adopted for a short period of time by NASA and by business corporations such as First National Bank, Union

Carbide, and Allied Chemical (Hansell, et al., 1982; Svenning, et al., 1984). During the 1980s, teleconferencing continued to flourish and it was adopted by numerous business organizations. Marketing research firms, The Wall Street Journal, and others predicted that the use of teleconferencing would climb from 1% to 90% by 1995 (Hansell, et al., 1982; Svenning, et al., 1984). Still, its usage has not risen to the degree that was predicted during the 1980s.

Now, with the advent of the information highway, the usage of teleconferencing can be expected to increase in all likelihood. Teleconferencing has the advantage of combining audio, computer, and video which are essential components in the modern educational process. The process of teleconferencing communication can be conceived of as interactive cycles in which information is exchanged synchronously (immediate feedback) and asynchronously (delayed feedback) among individuals or groups via teleconferencing media.

> The new communication medium will have one radical property that previous mass media lack: what is transmitted over the communication channel can be controlled more directly by the receiver than by the sender of the message (DeFleur and Ball-Rokeach, 1982, p. 104).

This study examines the utilization of teleconferencing as part of the information highway mainly among schools in North Carolina

while focusing on the government support, usage, costs, advantages and disadvantages, as well as ramifications of its use.

GOVERNMENT AND THE NATIONAL INFORMATION INFRASTRUCTURE

The National Information Infrastructure (NII) is the official name of the information system which was outlined by Vice President Gore in January 1994. He "urged the nation to wire every school, library, hospital, and clinic to the broad-band network by the end of the decade" (Graumann, 1994, p. 29).

Within three months of Vice President Gore's speech, the National Coordinating Committee for Technology in Education and Training issued a monograph on the NII. This prestigious group of educational and business organizations stipulated various access, application, and technical requirements that must be inherent in any infrastructure. For instance, they noted eight goals under educational and training application requirements. They are

- coordinate NII-related education and training activities conducted by federal departments and agencies,
- develop and disseminate NII guidelines for education and training applications,

- identify and disseminate effective education and training applications of the NII,
- integrate applications of NII and related technologies into education-reform plans,
- develop quality education and training applications for all NII,
- conduct research on the education and training applications of current and merging technologies,
- promote training, professional development, and technical assistance for educators as an integral part of the development of the NII, and
- support ongoing evaluation of the effectiveness and impact of the NII to inform policy makers and educators.

(DeLoughry, 1994, p. A25).

Both houses of the U.S. Congress have waffled on this issue. At times, they seem to favor high-tech solutions, for problems facing American education, as evidenced by the numerous calls for such legislation. Most notable were the

- National Competitiveness Act of 1993 [S. 4],
- National Information Infrastructure Act [H.R. 1757],
- Technology for Education Act [S. 1040], and
- Improving America's Schools Act [H.R. 3130]

(Graumann, 1994).

These four pieces of legislation revealed a concerted effort by

their proponents to get the country on a solid start along the information highway. However, partisan politics threw up a road block before long. The Senate leadership has recently acknowledged that "a bill which was intended to spur competition among communication companies by trimming federal regulations, had run into intense opposition that eliminated all chances for its passage this year" (Wilson, 1994, p. A21).

STATES AND INFORMATION HIGHWAY

A number of states have initiated their own branch of the information highway such as Arizona, Louisiana, Kansas, Texas, Utah, Vermont, and Virginia (Betts, 1994). Two of the most ambitious projects are underway in North Carolina and California. The project manager in North Carolina observed that the state's rapid acceleration of this project is largely driven by the existence of a politically receptive governor in Raleigh (Betts, 1994). Clear across the continent, commercial consortia are lining up to put the Golden State in the fast lane of the information highway.

While both of these states are enticing private companies such as Bell South and Pacific Bell to participate in the expansion of the information highway, each has embarked on a different strategy along this path. North Carolina has employed

a strategy whereby it places emphasis on the public sector first such as schools, hospitals, libraries, and government offices. This is a modified Push strategy inasmuch as

> the network is being built by telephone companies, which will own the system. The state, however, will be the major customer, using about 25% of the system. (Patterson, 1994, p. 2B)

California, on the other hand, seems to be using a Pull strategy "that aims to make commercial interests, not the state, the main source of revenues for upgrading the network" (Mills, 1994, p. 20). "Unlike North Carolina, however, this network will focus on homeshopping and movies on demand...not on educational and medical benefits for public institutions" (Mills, 1994, p. 20). Between these two states there exists great geographical distance as well as a wide latitude of options for other states which elect to enter the NII.

NORTH CAROLINA INFORMATION HIGHWAY

Perhaps it is appropriate that North Carolina, the state which helped give this nation its first chief export (i.e.; tobacco), should lead the way on this important change. Last July, the Tar Heel State was reported to be

> adopting a statewide fiber-optic network called the North Carolina Information Highway (NCIH). Though as many as 115

> sites are expected to be linked to NCIH by August, many of the network's features are still in the planning stages. (Rogers, 1994, p. 29)

During the summer of 1994, North Carolina moved ahead with the construction of "a $160 million statewide Asynchronous Transfer Mode (ATM) network that will link state agencies, schools and universities, courts, doctors and hospitals, local governments, and private companies" (Wallace, 1994, p. 1). At that time, it was observed that "though libraries are not included in the initial list of 115 sites to go on line this August, they are scheduled to be added in 1995 and 1996" (Rogers, 1994, p. 29).

Initially, ATM switches will be located in Asheville, Charlotte, Durham, Fayetteville, Greensboro, Greenville, Raleigh, Research Triangle Park, and Wilmington. These switches are being furnished by Fujitsu Incorporated. AT&T will supply the high-speed wide-area trunk line called Synchronous Optical Network (SONET) for one side of the switches. Meanwhile, three in-state phone companies (Carolina Telephone, GTE, and Southern Bell) will connect users to the other side (Wallace, 1994). "By the time NCIH is in full swing, it is expected to have 3400 sites" (Rogers, 1994, p. 29).

USAGE IN SCHOOLS

Among the current sites are various branches of the state university system, community colleges, and several public schools.

> North Carolina began its pilot program last year with 16 public schools. The legislature recently passed a bill to take the program beyond the experimental stage, providing $7 million for start-up costs. By January nearly 100 schools are expected to be hooked up, from Cape Hatteras High School on the Atlantic Coast to Tri-County Community College in Murphy, 400 miles away on the state's far western end. (Winerip, 1994, p. B7)

Many school districts, uncertain of the costs and the technology, proceed in cautious increments along the information highway. The New Hanover County School Board, for instance, opted in February 1994 to maintain only the fiber-optic programs at New Hanover and Hoggard high schools while Laney High School will have to wait until later in the year to be included (Herel, 1994).

Whatsmore, the offerings (current and potential) of such teleconferencing are considerable. A partial list includes

- **Distance Learning** (using two-way video/audio) is one option which has already been used in North Carolina. A Japanese language class was taught and transmitted

from Charlotte and received by students in Wilmington. Conversely, an oceanography course originating at Hoggard High School in Wilmington was transmitted to East Mecklenburg High School in the Charlotte vicinity (Winerip, 1994).

- **Video Fieldtrips** enable young people to visit various sites and ask questions of the veterinarians of Sea World in Florida with the help of video cameras and live connections.
- **Video Teleconferences.** Students can get together electronically for town meetings and debates. For example, last year, as part of a five-part series offered by Massachusetts Corporation for educational Telecommunications (MCET), students at several sites who were linked by video, telephone, and fax learned about the legislative process from members of the U.S. Congress and debated the merits of the Brady Bill.
- **Collaborative Projects.** Three schools in Mississippi were linked with three inner-city New York schools by using two-way video. They explored their own preconceptions about one another; and then, with guidance from editors at the New York Times, created a joint newspaper.
- **Teacher Training.** The ability to view classrooms from a remote site and to help with pre-service training and teacher supervision. In California, for example, San

Diego State University was linked (two-way) with an elementary school in Chula Vista, enabling university instructors to monitor student teachers without traveling to the site.

- **Online Research.** In the future, services will provide rapid access to the entire Library of Congress--complete with video and audio that students can incorporate into multimedia reports or teachers can use to enhance their lessons.
- **Electronic Mail.** It is one of the most exiting uses of modems in the classroom. E-mail enables students to send messages to peers in faraway places.
- **Home/school Communication** (homework hotlines). Students will be able to participate in classes even when they are sick and parents should be able to view their children performances from home. (Graumann, 1994)

COSTS

The cost curve for much of the related technology continues to decline. Still, it appears that expenditures for North Carolina schools to hook up to this phase of the information highway will entail at least the following. In March 1994, North Carolina officials reported that it would require $514 million just to place the complementary technologies in the classrooms

throughout the state (Simmons, 1994). This is a preliminary step which is needed before linking up to NCIH. The report called for

> - Five computers in every elementary and middle school classroom and a 30-station computer lab at each high school.
> - A computer work station with printer for every teacher.
> - A television monitor and videocassette recorder for each classroom.
> - At least one CD-ROM computer workstation, including video laser discs, for each school library.
>
> (Simmons, 1994, p. 3A)

Besides,

> State officials estimate that a high school must spend $110,000 to $150,000 to buy the equipment to hook into the fiber-optic system that instantly transmits these images, another $40,000 to $50,000 a year in telephone company user fees, as well as hire extra employees maintain the system. (Winerip, 1994, p. B7)

The technology advisor to the Governor indicated that "each school needs a technician to run the equipment and supervise the video classroom at a cost of about $30,000 in salary and benefits" (Winerip, 1994, p. B7).

Every school that joins NCIH would incur a one-time start-up fee of $2,295 plus a minimum monthly usage fee of $4,000 (Info,'

1994). The New Hanover County schools have calculated that they "also would have to fund a maintenance agreement for the equipment that would cost an estimated $2,500 annually" (Herel, 1994, p. 4A). The county is looking towards grants from the state totaling about $300,000 to cover some of their financial outlays, (Maley, 1994). Those grants are not expected until December 1994 which, in turn, has caused the further delay in adding Laney High School (one of the region's biggest) to the information highway. With such large expenditures, it was little wonder why the Duplin County School Board recently "did not object to the staff's recommendation against spending $225,000 to install information highway equipment in three high schools" (Hervey, 1994, p. 2B). Perhaps the ultimate indication that there will be no free ride on NII came in the Summer of 1994. The granddaddy of information networks, Internet, is loosing its free ride status. Instead, the National Science Foundation which directs this federally subsidized system plans to privatize it and charge fees (Abate, 1994).

ADVANTAGES AND DISADVANTAGES

There is a great deal of argument among concerned parties regarding the advantages and disadvantages of the information highway to education. Those who support such a project advocate that teleconferencing can reduce the constraints imposed by time

and place. It can allow an organization, such as a state education system, to draw on its resources and to refocus them in another time and place. Furthermore, the learning via teleconferencing generally allows the student an option to playback sections of a lesson which he/she may not have grasped at first. Such a feature is independent of time and place so it can be exploited after regular school hours and at home.

Besides, two groups which have historically been ignored by many educational systems in America may now benefit significantly from access to the information highway. These are the senior citizens and the handicapped. Senior citizens re-entering educational facilities are on the rise at all levels. Despite this, a traditional perception of awkwardness regarding the elderly in a young person's world remains. Distance learning holds forth great promise for senior citizens who want to enroll in a variety of practical courses such as health insurance assistance, leadership, and others without having to endure the discomfort which may arise from being surrounded by much younger students (Maley, 1994).

The handicapped can also benefit from the information highway. Newton Minow, the Director of The Annenberg Washington Program, pointed out that

for too long, American society has barred people with

> disabilities from countless domains of ordinary life-schools, workplaces, theaters, libraries-in a way that we perceived only recently as unjust. Communications technology is giving us the opportunity to rectify this injustice. (Blanck, 1994, p. 4)

Indicative of this trend, Minow observed that Braille and remote hookups were employed to facilitate the inclusion of handicapped participants during a Washington conference on teleconferencing in April 1994 (Blanck, 1994). For its proponents, teleconferencing is not the panacea for all that ails American education but it can lower the impediments and thereby ease the suffering of some students.

For those who oppose such technology, their apprehension tends to be focused on a number issues. Among these, there is a concern about whether or not NII and NCIH will perform as expected. Some components of the information highway seem to be thoroughly road tested such as PCs and fiber-optic cable while others remain to be proven such as ATMs and systems management. The following snafu occurred during a teleconference in January 1994 as UNC-Wilmington sought to participate in NII.

> The fiber-optic network was supposed to link Dr. Michael Smith, a dermatologist at East Carolina University, with patient Henry Jones in Ahoskie. Mr. Jones has a skin problem on his palms and heels. But when the camera zoomed

> in on the hospital room, it was discovered that Mr. Jones has skipped his doctor's appointment to go hunting. The audience had to settle for the hospital director, who happened to have a scabby lesion on his ear (Herel, 1994, pp. 1A, 4A).

It can also be argued that teleconferencing may filter out crucial empiricism in science classes. Similarly, courses in foreign languages and English may not translate well over such electronic media because nonverbal elements of the lecture may fail to be captured in the encoded video. In fact, some educational experts point out that the information highway is of nebulous value to a national school system which lags so far behind on basic technology. Evidence ascribed to this effect was concluded from a recent National Education Association (NEA) survey which

> found that schools already suffer a technology gap vis-a-vis business-only 12 percent of classrooms have telephones in them, fewer than a third of teachers have access to a fax machine, and only in the wealthier districts do the majority of schools have computers with modems. (Graumann, 1994, p. 34)

While some experts claim that cost savings will be derived from teleconferencing by using fewer teachers, they are basing

this estimate on a 'span of control' which may be unrealistic. It has been reported that an employee of Northern Telecom Corporation felt each instructor could handle 100 students over the NCIH; but, teachers who have used the system believe that the maximum ratio should only be 1 to 30 (Wallace, 1994). Moreover, states like Texas and Utah fear a 'brain drain' of their key information network personnel who may defect to corporations for bigger salaries (Betts, 1994).

FUTURE RAMIFICATIONS

Just as the computer has replaced the typewriter, teleconferencing stands poised to decrease (if not outright replace) the traditional classroom. This transition is presently underway in the corporate world because it makes good economic sense. It comes in the form of telecommuting from what has become known as the 'virtual office.' While corporate teleconferencing has been around for years (Noor Al-Deen), the national agenda calling for an information highway coupled with the rapid advances in multi-media technology will synergistically make it an economic necessity. Children who learn how to cope with this change in environment will be better positioned to adapt to the corporation of the near future. One likely mode for such orientation is the virtual classroom which employs telecommuting in lieu of the traditional school house.

Schools in America, especially public schools, have a long history of striving to provide all students with an equal education. They may not always be successful (Brown v. Board of Education, 347 U.S. 483, 1954) but at least they generally have tried to attain such equilibrium. Some advocates of educational access to the information highway have touted it as a method for achieving such fairness. Yet, a number of the poorer counties in North Carolina have taken issue with this logic because they lack the resources to pay for the expenditures which were outlined above. A 1994 cover story about the information highway in BYTE magazine warned "if proper precautions are not taken, the highway could become the province of the educated and economically privileged, dragging the U.S. even farther toward being a land of information haves and have-nots" (Reinhardt, 1994, p. 74).

The concept of an information highway sounds straight forward; but, where is it really going? With all the scientific and strategic planning at our disposal today, mankind is constantly duped into believing that technology offers the panacea for society's ills. However, technology has a rather nasty habit of providing us with unintended as well as unwanted consequences. Many of them actually add to society's malaise.

In the field of telecommunications, a number of instances quickly come to mind. The telephone has become intrusive on our time and privacy, such as when telemarketers pursue us at home

during evening hours. Nowadays, it appears that the major effect of television is to provoke violence as much as it is to report the same. A principle tool used in the downsizing of corporate organizations is the computer; many a middle manager owes his/her job loss to this rather efficient machine. Such examples should serve as cautionary road signs to those who wish to proceed with placing teleconferencing in the classroom.

CONCLUSION

Considering the rather dismal state of affairs in American education today, school systems are left to face a Hobson's choice regarding their entry onto NII. 'Generation X' has clearly voted with its feet on this issue as increasing numbers of them drop out of the traditional classroom. Many of those students who pass through the entire ritual of formal education are ultimately no match for similarly aged youths in parts of Western Europe and the Pacific Rim. This is cause for real alarm due to the fact that the commercial quest for qualified human resources is often oblivious to nationalities, as demonstrated by the 'brain drain' of Europe earlier this century.

The beginning stage of this communicative technology does not lend the information highway to a legitimately critical evaluation. Ad hoc endorsements may sound interesting and

current condemnations may be well-intended; but, only time will reveal what educational merits exist in the usage of the NCIH.

North Carolinians have always taken great pride in their down-home friendly Southern hospitality. Now, some of them want to empower their youngsters with the ability to communicate across the country or around the world. While this is both progressive and noble, it would indeed be a sad legacy if these children simultaneously loose the ability to communicate with their next-door neighbor. Tom R. Halfhill, a senior news editor with BYTE magazine has commented that "virtual communities are exciting and healthy, but they become a problem when they displace similar discourse in real communities" (Halfhill, 1994, p. 278). NCIH and its big sister NII are perhaps the classic irony. After all, they promise to enhance communications for humans while they also threaten to inhibit communication with humans. Certainly, they warrant greater caution and examination as society accelerates its use of NII.

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